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PATENT APPLICATION

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Examiner:

Title: **ELECTRONIC CAMERA AND BATTERY VOLTAGE CONTROLLING
METHOD EMPLOYED THEREIN FOR SUCCESSIVELY, RATHER
THAN SIMULTANEOUSLY, OPERATING CAMERA PORTIONS
DURING CONDITIONS OF LOW BATTERY VOLTAGE (as
amended)**

Commissioner for Patents
Box Patent Application
Washington, D. C. 20231

S I R:

PRELIMINARY AMENDMENT

Please amend the above-identified patent
application which is simultaneously filed herewith, as
follows:

IN THE TITLE-

Page 1, lines 2-3

Change the title from

"Electronic Camera and

Battery Voltage Controlling

Method Employed Therein" to
--ELECTRONIC CAMERA AND
BATTERY VOLTAGE CONTROLLING
METHOD EMPLOYED THEREIN FOR
SUCCESSIVELY, RATHER THAN
SIMULTANEOUSLY, OPERATING
CAMERA PORTIONS DURING
CONDITIONS OF LOW BATTERY
VOLTAGE--.

IN THE SPECIFICATION-

To facilitate entry of the following changes, the
Applicants have submitted herewith a marked-up
specification which depicts all the following changes along
with a substitute specification that incorporates these
changes.

Page 1,	line 16	Change "is appreciated" to
		--commercially preferred--;
	line 25	Change "supply" to --supplied--;
Page 2,	line 4	After "example,", insert --a--;
	line 9	After "emission,", insert --a--;
	line 11	Change "need constantly be" to
		--needs to be constantly--;
	line 12	Change "in" to --while--;
	line 15	Change "put" to --placed--;
	line 18	Delete "particularly";
	line 19	After "any", insert
		--particular--;

Page 7,	line 13	After "an", insert --alternate embodiment of the--;
Page 8,	line 4	Change "to" to --of--;
Page 9,	line 16	After "35", insert
		--(see Fig. 2)--;
	line 20	Delete "referring to Fig. 2,";
Page 10,	line 8	After "signal", insert a comma;
	same line	After "light", insert a comma;
Page 11,	line 17	Change "12" to --12, shown in Fig. 1,--;
Page 12,	line 25	Change "image-compressing" to --compressing--;
Page 13,	line 1	Change "it" to --resulting compressed image data--;
	line 12	Change "motor" to --monitor--;
	lines 12-13	Change "stops image displaying" to --ceases displaying an image--;
Page 14,	line 8	Change "4" to --5--;
Page 16,	line 6	Change "image-compress" to --compress--;
Page 17,	line 15	After "will", insert --still--;
	line 16	Delete "not fail to"; and

line 17 Change "portions" to
 --portion--;

Page 18, line 1 After "a", insert --sufficient--.
 line 7 Change "66" to --66, shown in
 FIG. 4,--;

Page 19, line 10 Change "necessitated" to
 --needed--; and
 line 17 Change "C.", first occurrence,
 to --C (step 73).--.

IN THE CLAIMS-

To facilitate entry of the following changes, the Applicants have submitted herewith substitute pages providing all the pending claims, as they now stand, incorporating the changes indicated below.

Delete claims 7-10.

Re-write claims 1-4 as follows:

- 1 --1. (amended) An electronic camera comprising:
- 2 a signal processor for processing [portion for signal-
- 3 processing] an imaged video signal obtained from an imaging
- 4 element to [form] store image data in a recording medium;
- 5 a monitor for displaying said image data;
- 6 an electronic flash device;

7 a battery for supplying [current] voltage to said
8 signal [processing portion] processor, said monitor and
9 said electronic flash device;
10 a battery voltage detector circuit; and
11 a system controller; wherein
12 said electronic flash device includes a capacitor
13 charged when no light is emitted from the flash device, and
14 a discharge tube which receives [receiving] an output from
15 said capacitor and, in response thereto, emits [emitting]
16 light; and
17 when an amount of electric charge remaining in said
18 battery is below a predetermined value, said system
19 controller initially prohibits charging said capacitor and
20 in addition thereto controls said monitor to operate only
21 for a period of time permitting a user to confirm data of
22 an image picked up and said system controller then controls
23 said monitor to be inoperable and thereafter carries out
24 charging said capacitor. [receives an output from said
25 battery voltage detector circuit (3), determines whether an
26 amount of electric charge remaining in said battery (2) is
27 below a predetermined value, and control displaying on said
28 monitor (11) and charging of said capacitor (C) not to be
29 simultaneously performed when the amount of electric charge
30 remaining in said battery (2) is below said predetermined
31 value.]

1 2. (amended) The electronic camera according to claim 1,
2 wherein said system controller also controls displaying on
3 said monitor and charging of said capacitor such that
4 display of the image data and charging of the capacitor are
5 [to be] simultaneously performed when the [an] amount of

6 electric charge remaining in said battery is at least equal
7 to said predetermined value.

1 3. (amended) The electronic camera according to claim 1,
2 wherein said predetermined value [is] represents half [a
3 value] of a full amount of the electric charge stored in
4 said battery.

1 4. (amended) The electronic camera according to claim 3,
2 wherein said system controller also controls displaying on
3 said monitor and charging of said capacitor such that
4 display of the image data and charging of the capacitor are
5 [to be] simultaneously performed when the [an] amount of
6 electric charge remaining in said battery is at least equal
7 to said predetermined value.

REMARKS

Specification amendments

A substitute specification is submitted herewith which incorporates all specification amendments. The substitute specification introduces no new matter into the application. Moreover, in accordance with the provisions of M.P.E.P. Section 608.01(q), the applicants have also enclosed a "marked-up" copy of the original specification, as filed. The substitute specification contains the same changes that are shown in the marked-up copy of the original specification.

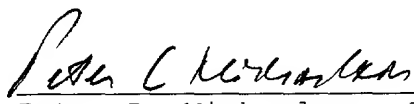
Claims 1-6 are pending. Claims 7-10 are the subject of an Appeal filed in Applicants' parent application.

In view of the amendments presented above, Applicants believe that all of the pending claims are allowable.

If, however, the Examiner believes that there are any unresolved issues requiring adverse final action in any of the claims now pending in the application, it is requested that the Examiner telephone Mr. Peter L. Michaelson, Esq. at (732) 530-6671 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

June 21, 2001


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EXPRESS MAIL CERTIFICATION

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Signature of person making certification

Peter L. MICHAELSON

Name of person making certification

632364290US

TITLE OF THE INVENTION

~~Electronic Camera and Battery Voltage Controlling
Method Employed Therein~~

5 ELECTRONIC CAMERA AND BATTERY VOLTAGE CONTROLLING
 METHOD EMPLOYED THEREIN FOR SUCCESSIVELY, RATHER
 THAN SIMULTANEOUSLY, OPERATING CAMERA PORTIONS DURING
 CONDITIONS OF LOW BATTERY

BACKGROUND OF THE INVENTION

Field of the Invention

10 The present invention relates to an electronic camera which is provided with an electronic flash and an LCD monitor and uses a battery as a power supply, and to a battery voltage controlling method employed therein.

Description of the Background Art

15 In recent years, electronic cameras in which an image formed by a CCD imager is signal-processed and stored in a recording medium, such as a flash memory, are in common use. In particular, the type integrally equipped with various accessories, such as an electronic
20 flash device and an LCD monitor, ~~is~~
~~appreciated commercially preferred.~~

Typically, this electronic camera uses a battery, such as a dry cell and a secondary cell, as a power supply. Thus, desirably, the load on the battery is
25 reduced as much as possible to contemplate longer life time of the battery itself and variations of battery voltage are also suppressed. With an electronic camera equipped with an electronic flash device, an LCD monitor and the like, however, the load of the electronic flash
30 device, LCD monitor and the like which receive power
~~supply-supplied~~ from the battery as well as the inherent load of the camera portion, such as a CCD imager and a signal processing circuit, poses a significant problem. For the electronic flash device, for example, a large

current is required to flow therethrough when the discharge tube of the electronic flash device emits light. Thus, when the capacitor for the electronic flash is charged during either light emission or non-light emission
5 | in preparation for the next light emission, a large current will flow from the battery and cause a large load. For the LCD monitor also, a predetermined driving voltage ~~need constantly be~~ needs to be constantly applied in while displaying an image.

10 | As described above, when the load of the electronic flash device and LCD monitor as well as the inherent load of the camera portion is ~~put placed~~ on the battery, battery voltage will significantly drop. When a sufficient amount of electric charge remains in the
15 | battery, a slight, additional application of load would not ~~particularly cause any~~ particular problems. When a small amount of electric charge remains in the battery, however, the output voltage will be reduced without any application of load, as compared with the case where a
20 | sufficient amount of electric charge remains in battery. If a large load is applied in this condition, a large drop in battery voltage is more readily caused.

The camera portion includes various types of integrated circuits and microcomputers for analog and
25 | digital processing. Thus, when battery voltage has significantly dropped, it falls below the lower limit at which the integrated circuits and microcomputers can properly operate, and proper signal processing might not be achieved.

30 | SUMMARY OF THE INVENTION

One object of the present invention is to provide an electronic camera and a battery voltage controlling method employed therein which are free from failures of an

internal circuit, such as a signal processing portion,
when a small amount of electric charge remains in a
battery.

Another object of the present invention is to provide
5 an electronic camera and a battery voltage controlling
method employed therein, wherein when a small amount of
electric charge remains in a battery, dropping of battery
voltage is reduced and failures of an internal circuit,
such as a signal processing portion, is thus prevented.

10 Still another object of the present invention is to
provide an electronic camera and a battery voltage
controlling method employed therein, wherein when a small
amount of electric charge remains in a battery, the
concentration of load on the battery is avoided to reduce
15 the dropping of battery voltage and thereby prevent
failures of an internal circuit, such as a signal
processing portion.

Still another object of the present invention is to
provide an electronic camera and a battery voltage
20 controlling method employing therein, wherein failures of
an internal circuit, such a signal processing portion, are
not caused when a small amount of electric charge remains
in a battery and wherein process time can be reduced when
a large amount of electric charge remains in the battery.

25 An electronic camera according to the present
invention includes a signal processing portion for signal-
processing an imaged video signal obtained from an imaging
element to form image data, a monitor for displaying the
image data, an electronic flash device, a battery for
30 supplying current to the signal processing portion, the
monitor and the electronic flash device, a battery voltage
detector circuit, and a system controller. The electronic
flash device includes a capacitor which is charged when

light is not emitted, and a discharge tube which receives an output of the capacitor and emits light. The system controller receives an output of the battery voltage detector circuit, determines whether the amount of electric charge remaining in the battery is less than a predetermined value, and controls displaying on the monitor and charging of the capacitor not to be simultaneously performed when the amount of electric charge remaining in the battery is less than the predetermined value.

In an electronic camera according to the present invention, displaying on the monitor and charging of the capacitor are not simultaneously performed when the amount of electric charge remaining in the battery is less than a predetermined value. Thus, the concentration of load on the battery can be avoided, and battery voltage will not suddenly drop even when there remains a small amount of electric charge in the battery. This prevents failures of an internal circuit, such as a signal processing portion, attributable to such a rapid drop of battery voltage.

Preferably, the system controller also controls displaying on the monitor and charging of the capacitor to be simultaneously performed when the amount of electric charge remaining in the battery is no less than a predetermined value.

In the electronic camera, the processings of interest for two loads can be simultaneously performed when a large, certain amount of electric charge remains in the battery. Accordingly, process time can be reduced.

A battery voltage controlling method employed in an electronic camera according to the present invention includes the steps of: detecting whether the amount of electric charge remaining in the battery is less than a

predetermined value; displaying on the monitor when the amount of electric charge remaining in the battery is less than the predetermined value; and charging the capacitor.

According to the battery voltage controlling method according to the present invention, when the amount of electric charge remaining in the battery is less than the predetermined value, displaying on the monitor and charging of the capacitor are successively performed rather than simultaneously performed. Thus, the concentration of load on the battery can be avoided, and battery voltage will not suddenly drop when there remains a small amount of electric charge in the battery. This can prevent failures of an internal circuit, such as a signal processing portion, attributable to such a sudden drop of battery voltage.

Preferably, the method also includes the step of simultaneously performing displaying on the monitor and charging of the capacitor when the amount of electric charge remaining in the battery is no less than the predetermined value.

According to the battery voltage controlling method, the processings of interest for two loads can simultaneously be performed when there remains a large, certain amount of electric charge in the battery. This can reduce process time.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram illustrating for a digital still camera according to one embodiment of the present

invention.

Fig. 2 illustrates an electronic flash device.

Fig. 3 illustrates an alternate embodiment of the
electronic flash device.

5 Fig. 4 is a flow chart of a processing in the digital
still camera.

Fig. 5 illustrates a change in battery voltage for a
remaining amount of electric charge in the battery of no
less than 50%.

10 Fig. 6 illustrates a change in battery voltage for a
remaining amount of electric charge in the battery of less
than 50%.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, a digital still camera as one
15 embodiment of the present invention includes: a shutter
button 1 via which the user provides an instruction to the
camera; a battery 2 removably mounted on the camera; a
battery voltage detector circuit 3 for detecting the
voltage value at the output stage of battery 2, applying
20 analog-digital conversion ~~to~~ of the detected voltage value
and outputting the converted voltage value; a system
controller 4 receiving an instruction from shutter button
1 and an output from battery voltage detector circuit 3
for controlling the driving of the power supply circuit 5
25 for processing analog signals, power supply circuit 7 for
processing digital signals and LCD power supply circuit 12
described later and for generating various control signals
to an electronic flash device 10; an analog processing
portion 6 configured of a drive circuit for a CCD imager
30 or the like for processing a video signal in the analog
stage; a digital processing portion 8 configured of a
color separation circuit, signal compression circuit and
the like for processing signals in the stage subsequent to

digital conversion of a video signal taken in from analog processing portion 6; and an LCD monitor 11 for displaying an image of an image data obtained through signal processing at digital processing portion 8.

5 Power supply circuit 5 for analog signal processing receives an output of battery 2 and supplies a driving voltage required for analog processing portion 6. More specifically, power supply circuit 5 for analog signal processing includes a DC/DC converter which changes a
10 battery voltage of 6V into a plurality of DC voltage levels each required for each portion of analog processing portion 6, and the operation of the DC/DC converter is controlled by system controller 4.

15 Power supply circuit 7 for digital signal processing receives an output from battery 2 and supplies a driving voltage required for digital processing portion 8. Power supply circuit 7 for digital signal processing includes a DC/DC converter which changes the level of battery voltage into a DC voltage level required for digital processing
20 portion 8, as in power supply circuit 5 for analog signal processing, and the operation of this DC/DC converter is also controlled by system controller 4.

Electronic flash device 10 includes voltage booster circuit 35 (see Fig. 2) for boosting the voltage of
25 battery 2, a discharge tube which receives power supply from battery 2 and emits light, and an electronic flash driving circuit which controls the driving of the discharge tube. More specifically, ~~referring to Fig. 2,~~ electronic flash device 10 includes a capacitor C which
30 can be charged by battery 2, a discharge tube 32 and a thyristor 33 both connected in parallel with capacitor C, a trigger circuit 31 which applies a high voltage for initiation to discharge tube 32 and also supplies gate

current to the gate of thyristor 33, a charge voltage detector circuit 30 which applies analog-digital conversion to that voltage at the both ends of capacitor C which has been divided by resistors R1 and R2 and outputs the converted voltage as charge voltage data, and a switch 34 connected in series to capacitor C.

Electronic flash device 10 emits light when system controller 4 provides to trigger circuit 31 a light emission control signal, as an instruction to emit light, to apply an initiating, high voltage to discharge tube 32 and simultaneously a base current is applied to the base of thyristor 33 and an output current from capacitor C and that of battery 2 flow into each of discharge tube 32 and thyristor 33.

Charging of capacitor C can be prevented by sending a switch control signal from system controller 4 after the completion of a light emission and thus opening switch 34. In order to charge capacitor C in preparation for the next light emission, the switch control signal is changed to close switch 34 and capacitor C is thus charged by an output from battery 2. Thus, the light emission by discharge tube 32 and the charging of capacitor C can all be controlled by the instructions from system controller 4. When capacitor C has been fully charged, switch 34 need be opened and the charging should be terminated, and system controller 4 compares charge voltage data from charge voltage detector circuit 30 with an expected, predetermined value obtained at full charge to determine whether capacitor C has been fully charged.

Electronic flash device 10 may be replaced with an electronic flash device 40 as shown in Fig. 3. Electronic flash device 40 is an electronic flash device 10 which has switch 34 removed therefrom and also has a voltage booster

circuit 35 replaced with a voltage booster circuit 36. Voltage booster circuit 36 receives a switch control signal and controls charging of capacitor C in a similar manner to that of a switch 34. More specifically, voltage booster circuit 36 places itself in the non-operating state in response to the switch control signal and thereby prevents capacitor C from being charged. Furthermore, voltage booster circuit 36 places itself in the operating state and thereby charges capacitor C.

LCD power supply circuit 12, shown in Fig. 1, receives an output of battery 2 and supplies a driving voltage required for LCD monitor 11. It should be noted that LCD power supply circuit 12, as well as power supply circuit 5 for analog signal processing and power supply circuit 7 for digital signal processing, includes a DC-DC converter.

Each portion of this digital still camera operates as follows. First, the operation when the remaining amount of electric charge in battery 2 exceeds 50% and thus there remains a sufficient amount of electric charge in battery 2, will now be described.

Referring to Figs. 4 and 5, when a power supply switch (not shown) of the camera is operated and the camera is powered on, an instruction is provided from system controller 4 to place power supply circuit 5 for analog signal processing, power supply circuit 7 for digital signal processing and LCD power supply circuit 12 all in the operating state, LCD monitor 11 is initiated (step 61) and the camera is placed in the standby state (step 62). In this standby state, an image signal is obtained by CCD imager in analog processing portion 6. Analog processing portion 6 applies a predetermined analog signal processing to the obtained image signal. Then,

well-known signal processings, such as white balance correction, color separation processing and the like, are applied in digital processing portion 8. The image data thus obtained is input to and displayed on LCD monitor 11.

5 While this standby state is maintained, LCD monitor 11 displays images successively. Thus, in this standby state, analog processing portion 6, digital processing portion 8 and LCD monitor 11 are the load on the battery. It should be noted that in the signal processing in
10 digital processing portion 8 in this standby state, the process of ~~image-compressing the ultimately obtained image data and then storing it-resulting compressed image data~~ in a flash memory is not performed. Thus, the image data displayed on LCD monitor 11 is only viewed through a view
15 finder.

When shutter button 1 is pressed in this standby state (Y at step 63), the camera is set to the state in the normal photographing mode for taking out image data for recording. In this state of the photographing mode,
20 system controller 4 still holds power supply circuit 5 for analog signal processing and power supply circuit 7 for digital signal processing in the operating state and instructs to place only LCD power supply circuit 12 in the non-operating state. Accordingly, LCD ~~meter-monitor 11~~
25 ~~stops image displaying ceases displaying an image~~ (step 64).

In the state in the photographing mode, the CCD imager of analog processing portion 6 is set to the exposed state, as in the standby state. During the
30 exposure, electronic flash device 10 emits light from timing b through timing c (step 65), and an image signal with the correct exposure is processed in analog signal at analog processing portion 6 and then in digital signal at

digital processing portion 8. It should be noted after an image signal for a still image of one frame for storing is taken out from the CCD imager, the CCD imager does not take in the next image until that particular state of the photographing mode is canceled. Thus, power supply circuit 5 for analog signal processing is shifted to the non-operating state at timing d, i.e., when the processing of a still image of one frame is completed and a signal is output to digital processing portion 8. Thus, during the initial period from a through b in the state in the photographing mode, analog processing portion 6 and digital processing portion 8 are the load on battery 2 and as can be seen in Fig. 45, battery voltage rises due to the absence of the load of LCD monitor 11, as compared with the battery voltage in the stand-by state. During the period from b through c, analog processing portion 6, digital processing portion 8 and electronic flash device 10 are the load and thus battery voltage significantly drops by that load. During the period from c through d, analog processing portion 6 and digital processing portion 8 are again the load and thus battery voltage returns to the initial level.

After timing d, at which power supply circuit 5 for analog signal processing goes into the non-operating state, only digital processing portion 8 continues signal processing. Furthermore, by the time when the timing e described later is reached, system controller 4 performs an operation for detecting the amount of remaining electric charge by comparing a detected value of battery voltage with a predetermined threshold value and making a decision that the remaining amount is at least 50% of the full amount when battery voltage exceeds the threshold value and a decision that the remaining amount is less

than 50% of the full amount when battery voltage does not reach the threshold value (step 66). The threshold value is here set at an output voltage which can be actually obtained from battery 2 with a load which can be driven by battery 2 having an amount of electric charge remaining in battery 2 of 50%.

When the processing for detecting the remaining amount of electric charge is performed (step 66) and it is determined that the amount of electric charge remaining in battery 2 is at least 50% of the full amount (N at step 67), charging of the capacitor is started at timing e, and during this charging at timing f LCD power supply circuit 12 is operated and an image is displayed on LCD monitor 11 (step 68).

More specifically, when timing e is reached, system controller 4 sends to electronic flash device 10 a switch control signal for instructing to start charging so that the switch is closed and capacitor C is placed in the charged state. This charging state is continued until timing g. Furthermore, at timing f, digital processing portion 8 completes formation of image data of one frame. At this time point, system controller 4 instructs LCD power supply circuit 12 to operate, and LCD monitor 11 is again powered on, takes the image data formed in digital processing portion 8 into an internal video memory and displays the image data as a still image.

Furthermore, after timing f, digital processing portion 8 continues to operate to ~~image~~-compress image data and then store it into a flash memory until timing h is reached (step 69). Meanwhile, LCD monitor 11 continues to display the image data of one frame taken into the video memory as a still image until timing h is reached and thus the user needs to confirm whether the image data

stored into the flash memory as a normal image is a desired image.

Thus, the load during the period from d through e is digital processing portion 8 only. Thus, battery voltage is maintained at the highest level. Furthermore, the load during the period from e through f are digital processing portion 8, electronic flash device 10 and capacitor C.

Thus, current flows into the capacitor C having a large capacitance and thus a high load is put on the battery and battery voltage significantly drops. The load during the period from f through g are digital processing portion 8, capacitor C and LCD monitor 11. Thus, battery voltage further drops by the load of LCD monitor 11, although it is gradually increased as capacitor C is charged.

Furthermore, the load during the period from g through h are digital processing portion 8 and LCD monitor 11.

After the storing of a desired image data of one frame into the flash memory is thus completed at timing h, a stand-by state is maintained until shutter button 1 is again pressed.

As described above, when there remains an amount of electric charge of at least 50% in battery 2, the output voltage is maintained at sufficiently high level if the load is somewhat increased. Thus, when the respective loads of LCD monitor 11 and capacitor C are simultaneously applied during the period from f through g in addition to the load of digital processing portion 8, which is essential as signal processing, the output voltage of power supply circuit 7 for digital signal processing will ~~still not fail to~~ maintain a driving voltage required for digital processing portions 8. Thus, it is preferable that the loads of digital processing portion 8, LCD monitor 11 and capacitor C are simultaneously applied to

reduce process time. When the amount of electric charge remaining in the battery is less than 50%, however, even a slight load will significantly decrease the output voltage of battery 2. Thus, when the loads of LCD monitor 11 and capacitor C are simultaneously applied, battery voltage rapidly drops and the output voltage of power supply circuit 7 for digital signal processing cannot maintain a sufficient driving voltage required for digital processing portion 8. Accordingly, various ICs and microcomputers which configure digital processing portion 8 go to the stop or reset state and cannot normally operate.

Thus, when a detection of the remaining amount of electric charge in the battery at step 66, shown in FIG. 4, results in the decision that the remaining amount is less than 50% (Y at step 67), the series of processings of steps 70-74 are performed.

The battery voltage during the series of processings changes as shown in Fig. 6. That is, the processing at analog processing portion 6 is completed and power supply circuit 5 for analog signal processing goes into the non-operating state at timing d and then only digital processing portion 8 performs signal processing which is completed at timing f, as is described above. However, when timing e is reached during this period, system controller 4 does not particularly instruct electronic flash device 10 to start charging. Thus, only digital processing portion 8 is the load on the battery until timing f is reached.

Then, system controller 4 instructs LCD power supply circuit 12 to operate (step 70). This allows LCD monitor 11 to take into the video memory the image data of one frame which has been processed at digital processing portion 8 and to display a still image. Digital

processing portion 8 completes at timing h the processing for image-compressing the formed image data and storing it into the flash memory (step 71). The displaying of the still image on LCD monitor 11 is continued until timing h is reached. Thus, digital processing portion 8 and LCD monitor 11 are the load on battery 2 during the period from f through h.

When timing h is reached, the digital signal processing is not ~~needed~~ needed, and system controller 4 instructs power supply circuit 7 for digital signal processing to stop operating and instructs LCD power supply circuit 12 to stop operating (step 72). LCD monitor 11 thus stops image displaying. Simultaneously, system controller 4 sends a switch control signal to electronic flash device 10 to close switch 34 and start to charge capacitor C (step 73). Capacitor C is kept charged until timing i is reached. During this charging period from h through i, power supply circuit 5 for analog signal processing, power supply circuit 7 for digital signal processing and LCD power supply circuit 12 are maintained in the non-operating state and only capacitor C is the load on battery 2. When timing i is thus reached and the charging of capacitor C is completed, system controller 4 instructs LCD power supply circuit 12 to operate so that LCD monitor 11 is placed in the image-displaying state (step 74). Simultaneously, system controller 4 can instruct power supply circuit 5 for analog signal processing and power supply circuit 7 for digital signal processing to operate to resume the processings at analog and digital processing portions 6 and 8 so that they return to the stand-by state.

The image display on LCD monitor 11 and the charging of capacitor C in electronic flash device 10 are thus

performed in time division manner when the amount of
remaining electric charge is less than 50%. While this
slightly increases process time, two loads are not
simultaneously applied to battery 2 and a drop of battery
5 voltage can thus be suppressed. Thus, the output voltage
of power supply circuit 7 for digital signal processing
does not fail to maintain a defined voltage value during
the period from f through g.

Although the above embodiment is described for 50% of
10 the full amount of electric charge remaining in the
battery as the threshold value of the amount of electric
charge remaining in the battery for determining whether
the driving of LCD monitor 11 and the charging of
capacitor C in electronic flash device 10 should be
15 simultaneously performed, the threshold value is not
limited to 50% and may be set at any optimal value, e.g.,
30% or 10%, depending on the relation between the load and
the battery. Furthermore, the timing at which battery
voltage is detected is not limited to the period from d
20 through e and may be any period during which a large
variation is not caused in battery voltage, such as the
period from a through b.

Furthermore, the result of which detection of the
amount of remaining electric charge that is performed by
25 system controller 4 is used not only for switching loads
but can be configured to be displayed on means for
displaying the remaining amount (not shown) and thus
informed to the user.

According to the invention described above, when a
30 small amount of electric charge remains in the battery,
the displaying on the LCD monitor and the charging of the
capacitor for the electronic flash can be performed in
time division manner to eliminate the possibility of a

rapid drop in battery voltage caused by the two types of loads simultaneously applied to the battery and prevent adverse effects on other signal processing circuits and the like. When there remains a large amount of electric charge in the battery, the processings of interest for the two types of loads can be simultaneously performed to reduce process time.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention being limited only by the terms of the appended claims.

(SANYO74DIVMARKED-UPSPEC/47:ca)